

COURSE: Prescribed Fire Planning and Implementation
TOPIC: Pre-Burn Planning and Preparation (Unit 3)
HANDOUT 6: Cumulative Effects of Weather and Drought on Fire Behavior

Cumulative Effects of Weather and Drought on Fire Behavior - A Summary

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In a prescribed burn plan you should address WHAT EFFECTS prolonged drought will have on your prescribed burning, HOW YOU ARE GOING TO TELL if you are in unusually dry conditions, and WHAT YOU ARE GOING TO DO if conditions are dry. In some agencies this is a required element of a burn plan.

In a very few cases you may have to burn under drought conditions in order to obtain your objectives and the ways you would deal with these conditions would be part of your normal planning process. For example, in order to open up areas in some wetlands you may need to wait until water levels are very low and the organic muck is dry enough to burn. Usually, however, burning under these conditions is undesirable; some burn bosses have had fires get away from them because they did not recognize that conditions were much drier than normal and the fire behavior turned out much higher than they expected. If prolonged drought will have positive effects on the outcome of your burn or will have no effect, this should be stated in the prescribed burn plan.

Effects on Fire Behavior and Smoke:

- Prolonged drought will cause drying of larger fuels and possibly litter, duff, and soil layers which do not normally burn. The Fire Behavior Prediction System (FBPS) fuel models, also known as Northern Forest Fire Lab (NFFL) fuel models, do not account for these fuels burning so BEHAVE will not predict this. As a result, **THESE FUELS WILL BURN AND ADD TO THE INTENSITY OF THE FIRE!** If you are in a drought situation, you can expect higher flame lengths, highly increased fireline intensity, resistance to control efforts, prolonged smoldering of large logs and duff layers, difficult mop-up, and lingering smoke problems. A fire of this intensity may cause you to exceed your objectives or cause undesired effects.
- Prolonged drought may affect live fuel moisture. In normal conditions, live vegetation such as tree trunks and limbs may have a high enough moisture content so that they do not contribute to fire behavior. In drought conditions live fuel moisture may be abnormally low, which will lead to more extreme burning conditions than you would expect.
- FBPS and NFDRS (National Fire Danger Rating System) fuel models which contain 100-hour, 1000-hour, and live fuels will be more affected by cumulative drought. Drought

will not have as much effect on grasses (FBPS fuel models 1 and 3) since fuels are composed mostly of 1-hour fuels which will be more affected by temp. and RH than prolonged drought.

- Drought may have a profound effect on marsh-type and fuels since the organic soils may add to the intensity, mop-up problem, and smoke production if they are dry! You may wind up with something resembling a peat fire. If soils are not organic, cumulative drought will not cause them to contribute to additional fire intensity although the duff on top of the soils may.
- In severe cases vegetation such as grasses and herbs may not even green up or may cure out earlier than expected, so the green fuels you thought you were going to have as a barrier when you wrote the plan may be dry and able to carry fire. The altered phenology caused by a drought may also prevent the regrowth of vegetation on your burn unit which is the desired objective of the burn.
- Wet areas that you were counting on as a barrier may be much lower than necessary to conduct a safe burn. Water sources that you normally rely on for refilling engines or water tenders may be dried up.
- Fuels affected by drought near the perimeter may create high intensity that will cause control problems (either intensity or spotting) if extremely dry.
- You may face constraints on burning due to other fire activity. If conditions are unusually dry there may be so many wildfires in the area that people you would be counting on to respond to an escape are unavailable to respond. Check the descriptions of the local, Geographic Area, and National Preparedness Levels to find out at which point additional approvals are necessary to conduct prescribed burns.
- Some states impose burn bans when certain levels of drought or burning conditions develops

How to tell if you are in unusually dry conditions:

Each station, area, or region will have to determine which of the following drought indicators is appropriate for their fuels and conditions. You should build a file relating fire behavior and fire effects to drought indicators based on your experiences with prescribed and wildfires.

- The most common way to monitor drought conditions is to follow whether precipitation is below normal at your station. But be careful - precipitation can be above normal for the year, but BELOW normal for the last 4 or 5 months, leading to abnormally dry conditions. If possible use one of the other indices rather than relying on average precipitation.
- The National Fire Danger Rating System is the most common method of tracking burning conditions. The ERC (Energy Release Component) is a good indicator of how much drying has gone on and when burning conditions are getting severe. The Keetch-Byram Drought Index (KBDI) is another output of the NFDRS that specifically tracks drought

conditions. The Burning Index (BI) will fluctuate more than the ERC and is therefore not as good at tracking long-term trends.

- The Canadian Forest Fire Danger Rating System (CFFDRS) was designed to track cumulative drying, especially in deep duff and organic soils. Although it was developed for northern forest types some other areas have found that some of the indices work well for them.
- Nearby automated weather stations will probably calculate dead and live fuel moisture and NFDRS indices which indicate what the burning conditions are for their area. Some weather stations will calculate fire danger based on either the U.S. or Canadian system. If you do not have direct access to the weather station outputs or to the NFDRS indices found in WIMS (Weather Information Management System) the nearest fire dispatch office should be able to give you information on conditions around the area. The farther you are from a weather station, the less accurate the indices will be for your station.
- The KBDI, Palmer Drought Index, and Departure from Average Greenness are indicators that can be accessed for information on regional conditions, sometimes down to county level. This data and other useful information on fire danger can be found at the Wildland Fire Assessment System (WFAS) on the Internet (<http://www.fs.fed.us/land/wfas/welcome/htm>).
- The Keetch-Byram Drought Index (KBDI) can be calculated at any station using a rain gauge and simple mathematical calculations. Since they are simple, they are often made and kept by field offices that do not have access to RAWs stations and NFDRS calculations, and will be more accurate than the broad-scale indicators found on the Internet. These calculations will also provide a much better indicator of drought conditions than relying on whether precipitation for the year to date is above or below normal.
- NRCS may have current local soil moisture data that can be used to build a local reference for burning conditions.
- Some states have issue range fire indices daily. Consult with the National Weather Service. These are sometimes available on the Internet.
- In some cases a drought index is not as important as the effect of drought on the vegetation that will be burned and the most important indicator is some sort of visual or physical inspection of critical plants to reveal their level of stress or stage of development.

What you will do when you recognize that you're in a drought situation:

Your prescribed burn plan should state specific actions you will take to mitigate the effects once you have recognized the drought situation. If you are in drought conditions you may have to do something to mitigate the effects such as:

- Postpone the burn
- Have additional holding forces on hand (your plan should specify what kind of resources

- and how many are needed once you have reached a trigger point dryness level)
- Have additional water sources available
 - Burn under less severe conditions
 - Spend greater effort on mop-up
 - Monitor the fire more thoroughly to make sure it=s out
- Don=t be fooled! If only a light rain occurs after a prolonged dry spell the interior of large woody fuels and deep organic layers will still be dry. You could make the mistake of thinking that because you just got a rain conditions are back to normal. It would only take a slight amount of drying to put you right back in severe conditions.
- Spring burning is often done when larger woody fuels are wet from winter precipitation. If winter precipitation has been below average for the area, consider postponing burning for the season or until after a significant rainfall (2+ inches).
- IF NOTHING ELSE: your plan should indicate that you will consult with your Fire Management Officer if the nearest weather station is showing below normal precipitation or your observations indicate that conditions are drier than normal.

Example

CUMULATIVE EFFECTS OF DROUGHT ON FIRE BEHAVIOR:

Since fuel model 3 has only 1-hour fuels, the effects of prolonged drought will be minimal, however, areas adjacent to the proposed burn area contains fuel models 8 and 9. These timber fuel models could pose major control problems if the burn is conducted during drought conditions. Drought conditions would effect both timber litter as well as 100 hour and 1000 hour fuels. If the annual rainfall is significantly below normal; Keetch Byram Index (KBDI) is greater than 400; or Palmer Drought Index (PDI) indicates the area is in moderate drought conditions (-2.0 to -2.9 on scale), mitigation will require the use of additional holding personnel and the use of more foam and water. If KBDI is greater than 600; or PDI is greater than -4 (extreme drought), the burn will be postponed either until a time when weather conditions, or to the following year.

The burn will not be completed if county or state burn bans are in effect.

If burn is conducted during a time when timber litter will burn, 2 additional personnel will be required for holding.